Linzer biol. Beitr.	36/1	265-271	30.7.2004

New data on the structure of the flagellum in males of the genus *Apechthis* FOERSTER (Hymenoptera, Ichneumonidae, Pimplinae)

J. KOLAROV

A b s t r a c t : Newly discovered tyloids in the genus *Apechthis* are described, figured and discussed. A key for identification of Western Palaearctic *Apechthis* species is proposed.

K e y w o r d s : Western Palaearctic Ichneumonidae, *Apechthis*, tyloids, key.

Introduction

Male specimens of many Ichneumonidae species have special formations – tyloids, on the lateral part of some segments of the antennal flagellum. Tyloids represent raised sections of the surface of the antennal segment and have various, most frequently elongated-oval, shapes. Their presence on the flagellum of only male specimens suggests that their function is probably connected with finding and identifying the female specimens of their own species. Lately BIN et al. (1999) present evidence that tyloids may be secretory organs involved in recognition of the male by the female.

Within the subfamily Pimplinae, tyloids have been known to exist only in the species of the genera *Pimpla* F. and *Strongylopsis* BRAUNS (TOWNES 1969; KASPARYAN 1974a, 1974b; 1981; GOKHMAN & KRUTOV 1996). We have established in our studies that tyloids are also present in some species of the genus *Apechthis* FOERSTER 1868.

Material and methods

Forty-four male specimens of the species *Apechthis rufata* GMELIN, *A. compunctor* LINNAEUS and *A. quadridentata* THOMSON, kept in the author's collection, were studied. Tyloids were examined with a Technival-2 stereomicroscope. The scanned photographs attached herewith were taken with a SEM Philips 515 at 10-20 kV in a secondary electronic mode. Scanned flagella were preliminary coated with a gold layer of 300-400 A.

Results and discussion

Tyloids in species of the genus *Apechthis* were of a linear type and occupied the entire, or almost the entire, length of the flagellum segment. In this respect, they resemble the

tyloids of *Pimpla hypochondriaca* RETZIUS and differ from the tyloids of *Strongylopsis abdominalis* KASPARYAN, which are shorter than the flagellum segments whereon they are situated. In *Apechthis compunctor* tyloids were found on flagellum segments 5th to 9th (Fig. 1-5), and in *A. quadridentata* and *A. rufata* – on flagellum segments 5th to 10th (Fig. 6-17). Unfortunately, we had no male specimens of *A. capulifera* KRIECHBAUMER, but most probably tyloids are to be found on the flagellum of this species as well.

Tyloids on the fifth flagellar segment were developed only on the apical part (Fig. 1, Fig 6. and Fig. 12) and tyloids on segment 9th (10th) (Fig. 5, Fig. 11 and Fig. 17) – only on its basal half. At increased magnification (× 1500), it was possible to see that the tyloid surface had a granular structure and was covered with small pores (Fig. 18). ISIDORO et al. (1996) suggested that these pores were canals of glands, releasing secretions, thus recognizing the opposite sex of its own species.

As in most ichneumonids, the antennal flagellum in males of the examined species of the genus *Apechthis* had two basic types of sensilla – trichoid and placoid. As a rule, such sensilla are not developed on tyloids, except for the Ichneumoninae subfamily (GOKHMAN & KRUTOV 1996). In the specimens examined by us, the presence of trichoid sensilla on tyloids was observed only as an exception.

In many Ichneumonidae species, the reliable identification of male specimens was often impossible. The presence or absence of tyloids, their number and position, shape and structure may increase significantly the identification of males. There is no doubt that any efforts made in this respect will be successful. In our previous studies (KOLAROV 1986) of many species of *Stenomacrus* FOERSTER 1868, flagellum segments with developed tyloids were reported for the first time.

The absence of tyloids and the hyper-concave internal eye orbits were the reason for the genus *Apechthis* to be classified nearer to the genus *Itoplectis* FOERSTER, which also has hyper-concave eye orbits and flagellum without tyloids. Upon finding tyloids in the genus *Apechthis*, its connection with the genera *Pimpla* and *Strongylopsis* seems more natural. Moreover in an analysis of 166 morphological and life history characters (but not the here mentioned), GAULD et al. (2002) conclude that *Itoplectis* is paraphyletic with respect to *Apechthis*.

When examining the tyloids in the representatives of the subfamily Ichneumoninae, GOKHMAN & KRUTOV (1996) reported that the weak development of tyloids in Phaeogenini and their strong development in Protichneumonini and Callajoppina obviously correlated with the level of the general evolutional development of these taxa. They pointed out, however, that the characteristics of the external structure of tyloids were not synapomorphic in the strictest sense of the term. Within the subfamily Pimplinae, tyloids were established only in some genera of the tribe Pimplini, which includes only endoparasitoids. For designation of such a trend, the term "underlying synapomorphy", suggested by SAETHER (1979), seems more appropriate.

With the strongly curved apex of their ovipositor, the female specimens of the genus *Apechthis* are easily differentiated from the specimens of the other genera of not only the tribe Pimplini but of all other Ichneumonidae as well. Upon finding tyloids on the flagellum of the species of the genus *Apechthis*, the distinction of the males from those of the close genus *Itoplectis* poses no problems.

For identification of the species of the genus *Apechthis*, there exist reliable characteristics

in female specimens, i.e., the presence or absence of an additional tooth in the tarsal claws, the shape of the first tergite, etc. (KASPARYAN 1973, 1981). For identification of the male specimens of some species of the genus, only the character of coloration, this quite often varying a lot, has been used so far. There is a noticeable difference in the position of tyloids in the separate species of the genus *Apechthis*, which may be used for a more reliable identification of male specimens. This allows the key to identification, suggested by KASPARYAN (1973, 1981), to be supplemented and modified as follows:

Key for determination of the western palaearctic species of the genus *Apechthis*

1 Males 2
- Females 5
2 Hind coxa black ..... *A. capulifera* (KRIECHBAUMER)
- Hind coxa red 3
3 Propodeum, viewed from the basaly side with brown hairs. Hind tibia entirely red, rarely darkened at the apex. Face yellow, usually with black spot in the middle. 5th-9th flagellar segments with tyloids (Fig. 1-5); thyloid on 9th segment no longer than half of segment; 9th flagellar segment about 2,0 as long as wide ..... *A. compunctor* (LINNAEUS)
- Propodeum with pale hairs. Hind tibia with distinct white sub-basal ring. Face usually entirely yellow. 5th-10th flagellar segments with tyloids (Fig. 6-17) 4
4 Apical third of VI-VII tergites smooth and lustrous, fine and rarely, but distinctly punctured; the distance between punctures 2,0 as long as their diameter. Hind half of mesoscutum entirely black. 9th flagellar segment 1,6 as long as wide ..... *A. quadridentata* (THOMSON)
- Apical thirds of VI-VII tergites matt, punctured, but not distinctly. Hind half of mesoscutum with 2 longitudinal yellow stripes. 9th flagellar segment 1,9 as long as wide ..... *A. rufata* (GMELIN)
5 Hind tarsal claws without basal tooth. Mesoscutum usually black entirely ..... *A. quadridentata* (THOMSON)
- Hind tarsal claws with basal tooth 6
6 Coxae, sometimes hind femur apically, black ..... *A. capulifera* (KRIECHBAUMER)
- Coxae and femora red coloured 7
7 Propodeum, viewed from the basaly side, with brown hairs. Hind tibia red, sometimes weakly darkened to apex. Mesoscutum usually without wellow markings ..... *A. compunctor* (LINNAEUS)
- Propodeum with pale hairs. Hind tibia with distinct white subbasal ring. Mesoscutum with pair of yellow stripes on the place of notauli ..... *A. rufata* (GMELIN)

Literature

BIN F., ISIDORO N. & R. ROMANI (1999): Antennal structures of Hymenoptera: sensilla or glands? — Atti dell'Accademia Nazionale Italiana di Entomologia Rendiconti **47**: 251-263.

GAULD I.D., WAHL D.B. & G. BROAD (2002): The suprageneric groups of the Pimplinae (Hymenoptera: Ichneumonidae): a cladistic re-evaluation and evolutionary biological study. — Zoological Journal of the Linnean Society **136**: 421-485.

GOKHMAN V.E. & V.V. KRUTOV (1996): On external structure of male antennae in the subfamily Ichneumoninae (Hymenoptera, Ichneumonidae) and related groups. — Zoologicheskii Zhurnal **75** (8): 1182-1194.

ISIDORO N., BIN F., COLAZZA S. & S.B. VINSON (1996): Morphology of antennal gustatory sensilla and glands in some parasitoid Hymenoptera with hypothesis on their role in sex and host recognition. — Journal of Hymenoptera Researsh **5**: 206-239.

KASPARYAN D.R. (1973): Review of Palearctic ichneumonids of the tribe Pimplini (Hymenoptera, Ichneumonidae). The genera *Itoplectis* FOERSTER and *Apechthis* FOERSTER — Entomological Revue **52** (3): 665-681. (in Russian, English abstr.).

KASPARYAN D.R. (1974a): A review of Palearctic species of the tribe Pimplini (Hymenoptera, Ichneumonidae). The genus *Pimpla* FABRICIUS. — Entomological Revue **53** (2): 382-403. (in Russian, English abstr.).

KASPARYAN D.R. (1974b): A review of Palearctic species of the tribe Pimplini (Hymenoptera, Ichneumonidae). The genus *Strongylopsis* BRAUNS. — Zoologicheskii Zhurnal **53**: 1574-1576. (in Russian, English abstr.).

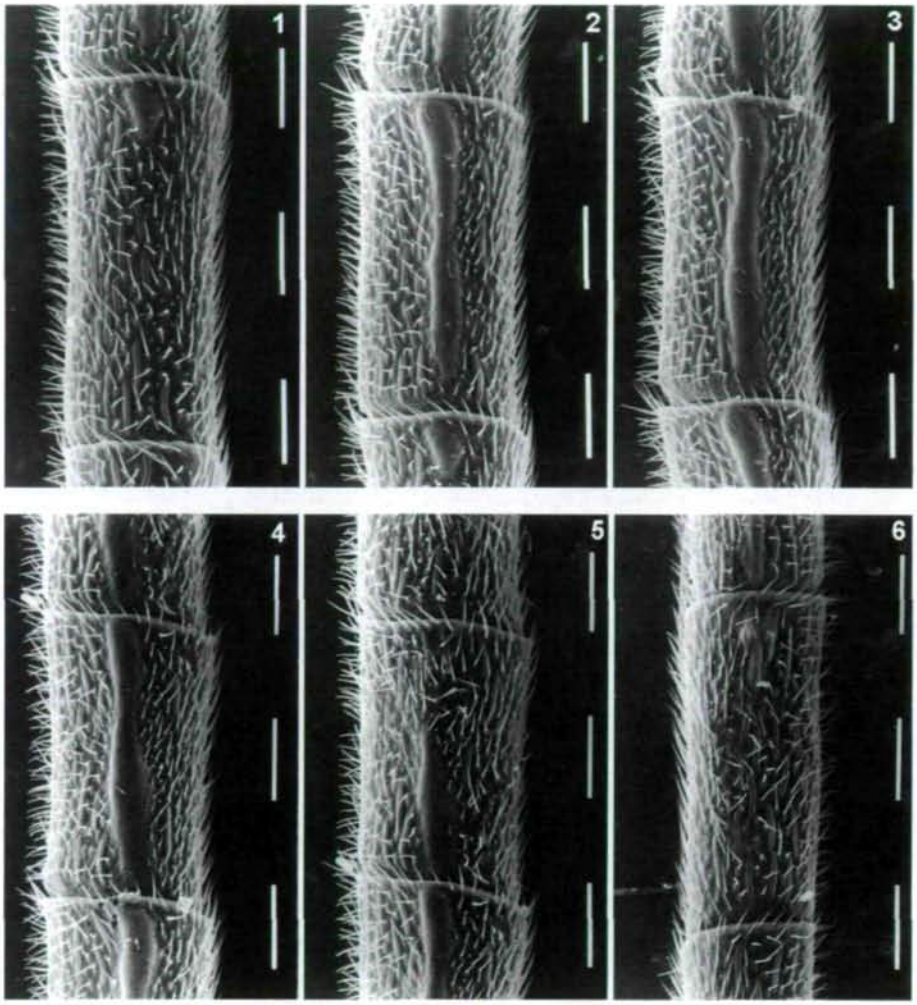
KASPARYAN D.R. (1981): [A guide to the insects of the european part of the USSR. Hymenoptera, Ichneumonidae. Subfamily Pimplinae (Ephialtinae)]. (in Russian). — Opredeliteli Faune SSSR **129**: 41-97.

KOLAROV J. (1986): A revision of the Orthocentrinae of Bulgaria (Hymenoptera, Ichneumonidae). — Annales Historico-Naturales Musei Nationalis Hungarici **78**: 255-264.

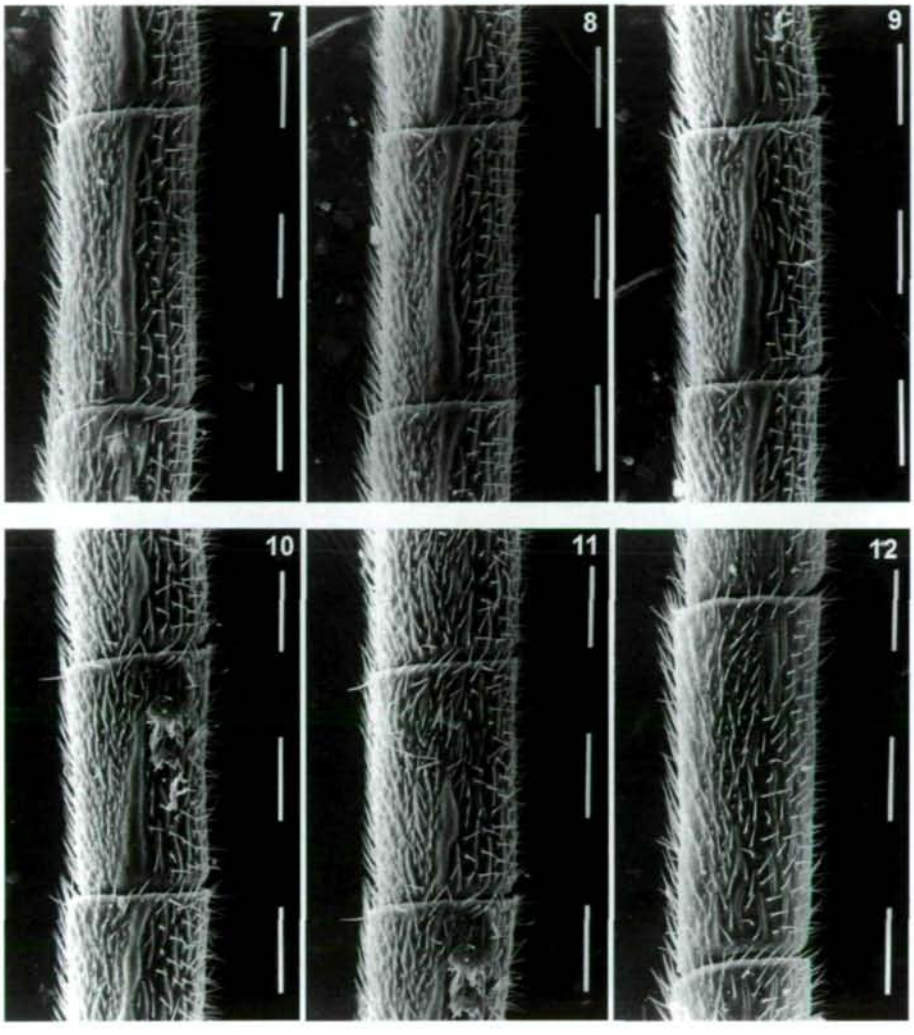
SAETHER O.A. (1979): Underlying synapomorphies and anagenetic analysis. — Zool. Scripta **8** (4): 305-312.

TOWNES H. (1969): The genera of Ichneumonidae, Part 1. — Memoirs of American Entomological Institute **11**: 300 pp.

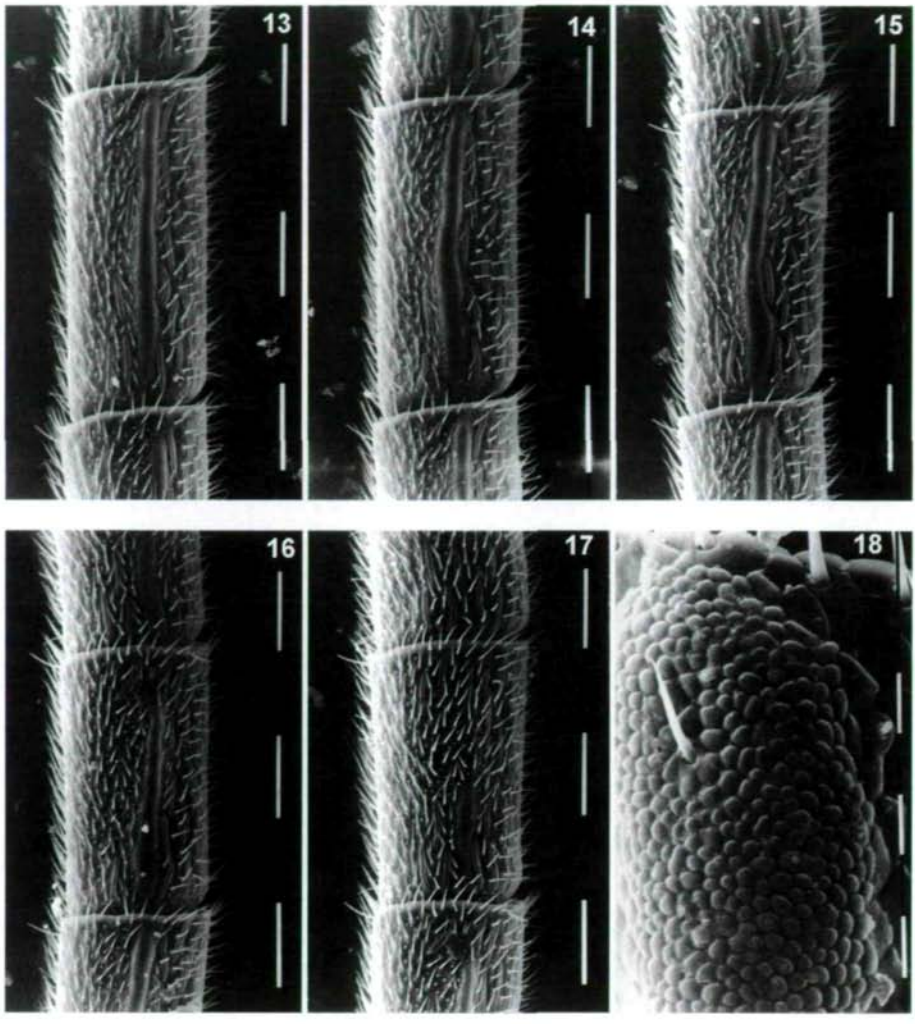
Author's address: Janko KOLAROV
Faculty of Pedagogie, University of Plovdiv
BG-24 Tsar Assen Str., 4000 Plovdiv, Bulgaria
E-Mail: j.kolarov@pu.acad.bg



Figs. 1-6: Tyloids on flagellar segments in *Apechthis* species; **1-5**, in *Apechthis compunctor*, **6**, in *A. quadridentata*; **1** – 5th segment; **2** – 6th segment; **3** – 7th segment; **4** – 8th segment; **5** – 9th segment; **6** – 5th segment.



Figs. 7-12: Tyloids on flagellar segments in *Apechthis* species: **7-11**, in *A. quadridentata*, **12**, in *A. rufata*; **7** – 6th segment; **8** – 7th segment; **9** – 8th segment; **10** – 9th segment; **11** – 10th segment; **12** – 5th segment.



Figs. 13-18: Tyloids on flagellar segments in *Apechthis rufata*: **13** – 6th segment; **14** – 7th segment; **15** – 8th segment; **16** – 9th segment; **17** – 10th segment; **18** – part of tyloid X 1500.